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AUTHOR Hyer, Anna L.
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ABSTRACT

After three centuries of education in the United States, the teacher's role has been little affected by the introduction of media, and it has been even less affected by the much more recent concept of a technology of instruction. About 1960 the educational community began to realize that instructional technology is different from audiovisual education, that the use of media should be an integral part of the instructional system, and that instructional technology will change the role of the teacher. Schools began to acquire hardware and software and to make efforts to retrain teachers in their use. Although most schools are still operating on the basis of the "audiovisual aid" definition of educational technology, a clear trend among a few "leader schools" toward a more sophisticated application of technology can be discerned. Within the next ten to fifteen years major changes will have to be made in the training and retraining of teachers to give more emphasis on individualizing instruction, operating as a member of a team, assessing pupil achievement and diagnosing learning difficulties, providing a working knowledge of technology and selecting and/or producing instructional material and instructional systems. Several problems lie ahead in the re-education process, and steps must be taken to facilitate the role change of the teacher. (Author/JY)

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EFFECT ON TEACHER ROLE OF THE INTRODUCTION OF EDUCATIONAL TECHNOLOGY AND MEDIA INTO SCHOOLS

Paper Prepared for
Organisation for Economic Cooperation and Development

By

Anna L. Hyer
Specialist, Educational Technology
Division of Instruction and Professional Development
National Education Association
USA

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EFFECT ON TEACHER ROLE OF THE INTRODUCTION OF EDUCATIONAL TECHNOLOGY AND MEDIA INTO SCHOOLS

SUMMARY OF KEY ISSUES

After three centuries of education in the United States, the teacher's role has been little affected by the introduction of media, and it has been even less affected by the much more recent concept of a technology of instruction. Although equipment and materials are relatively plentiful, audiovisual materials remain an "aid" to the majority of teachers, chiefly used for presentational purposes.

In this paper, the term "media" is used to refer to those materials and devices used in the processes of teaching and/or learning. The term "instructional technology" is defined as a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction.

Education in the United States after 1960 has seen the beginnings of instructional technology. The educational community has begun to realize that instructional technology is different from audiovisual education, that the use of media should be an integral part of the instructional system and that instructional technology will change the role of the teacher. This period has seen the tooling up of the schools with hardware and software and fairly massive efforts to retrain teachers. The functions of media have also been broaden from the emphasis on the presentation function to newer uses such as self-analysis, interaction and self-instruction.

At this time in the United States most schools are operating at what this paper calls "level One," that is, the "aid" or "product" definition of educational technology. However, there is now a clear trend among a few "leader schools" toward the much more sophisticated application of technology that is characterized by the "process" approach, or, what in this paper we have described as "Level Two." The role of the teacher is different under each of these technological patterns. Under Level One the

teacher is teamed with media. In Level Two media may substitute for certain functions of a teacher, thus causing critical changes in the functions of the teacher. The direction tends to be away from the lecture-tell method and in the direction of discovery methodology, and more individualized instruction. This means that the teacher will spend less time on information transmission as compared with the more "human" roles such as modeling, guidance, interpersonal relations and classroom management.

Within the next ten to fifteen years major changes will have to be made in the training and retraining of teachers. More emphasis will need to be given to individualizing instruction, operating as a member of a team, accessing pupil achievement and diagnosing learning difficulties, providing a working knowledge of technology and of man-machine relationships, and the selecting, modifying and/or producing of instructional materials and instructional systems. The paper suggests several of the problems that lie ahead in this re-education process and suggests some steps to facilitate the role change of the teacher.

"No occupation -- perhaps not even teaching --
is immune from technological change."
- Robert M. Hutchins

Introduction

After three centuries of education in the United States, the teacher's role has been little affected by the introduction of media, and it has been even less affected by the much more recent and much more elegant concept of educational technology.

The OECD Secretariat's invitation for this paper included the following assumption:

> This is a subject on which there should be enough experience in the U.S.A. for an objective assessment of the problems which arise, treated in the broader context of the relative effectiveness in comparison with the more traditional approaches, and also of the impact which they had on teacher roles and reactions. We would hope that such a paper would endeavor to present U.S. experience in this field in a way that would contribute to a clarification of a controversy that has arisen around this matter.

In retrospect, my initial response to the invitation represented a more positive and a more optomistic stance than I have been able to sustain in this paper. Certainly, as it seemed at the outset, there is enough evidence to permit a fairly objective assessment of the problem and to generate some recommendations concerning the effects on the role of the teacher as a result of new educational technology and media in primary and secondary schools. Now, having completed this assignment to the best of my ability, I am much less convinced that the assumption on which the invitation was based can be supported. Perhaps others can learn, however, from what we in the U.S.A. have tried with limited success.

The fact is that there has been enough experience for an assessment, but the necessary data were never collected or at least not collected and documented in a way that can be useful in answering the questions posed. To a degree this paper represents

a limited attempt to do this. But we are plagued by the fact that dramatic innovations when widely publicized are followed by the need to claim success by those trying out the innovations. Thus, problems are minimalized and gains inflated. This phenomenon may not be limited to the United States, but it is certainly compounded by the decentralized nature of our educational efforts.

The Secretariat wisely distinguished between educational technology and media - wisely because the role of the teacher varies greatly in a "media oriented" school and in a "technologically oriented" school. Educational media are universally used in education today whereas educational technology tends to be accepted in name but hardly at all in application. Certainly, bits and pieces of what one day may be a technology of instruction can be found in the schools today, but no single school in the United States has more than a few of the elements which must be assembled into a technological system. It may be appropriate at this point to distinguish between the two terms.

Instructional media are those materials and devices utilized in the teaching and/or learning process. The Commission on Instructional Technology, appointed by the Secretary of Health, Education and Welfare of the U. S. Government in 1968, defined instructional technology as "a systematic way of designing, carrying out, and evaluating the total process of learning and teaching in terms of specific objectives, based on research in human learning and communication, and employing a combination of human and non-human resources to bring about more effective instruction."

Hoban, in 1962, was one of the first to clearly differentiate between media and technology.

> The point here is that the term, educational media does not, in itself, suggest the ramifications for research and for educational policy and operating procedures which are inherent in the term, technology of education. Technology is not just machines and men. It is a complex, integrated organization of men and machines, of ideas, of procedures, and of management. The introduction of this complex organization generates many systematic problems that can be and have been ignored or generally neglected in theory research, and practice in education. The term, educational media, limits; and the term educational technology, expands the areas of theoretical development, research, and implementation in education. (21:124)

It can be seen that the concept of educational media is quite different from the much broader concept of a technology of education. It can also be seen that the two concepts will have quite different effects on the role of the teacher.

Background on Education in the U. S. A.

The first fifty years after the attainment of independence was a period when many ideas were argued and fought over as the new nation attempted to develop the framework for its institutions. Education was no exception. Out of this period grew the following premises upon which education in the United States is based:

1. If a republican government is to prosper, the people must be educated.
2. This can best be done if all children attend the same public schools together and are separated only for religious education.
3. The language of the school should be English.
4. Free schools should be provided serving both the children of the rich and the poor.
5. Everyone must participate in paying for this government sponsored education.
6. The legal responsibility for the schools rests with the states rather than the national government.
7. Local school boards should be created which represent the people.

Whereas the goal of the first century in the United States was to provide some education for all and much education for a few, the goal in the last century has been to provide as much education as possible for everyone. By 1960, over 99% of children ages 6-13 and nearly 90% of those aged 14-17 were attending school. Although the thrust for an increase in the quantity in education seems to be continuing into the last half of the 20th Century, it is overshadowed by an emphasis on increased quality in education.

This has led to experimentation and innovation in teacher education and in the curriculum and methodology of the elementary and secondary schools, and the beginnings of experimentation with instructional technology in its true sense. This progress has been stimulated by money provided by the federal government for purchase of instructional materials and equipment, research in education, introduction of innovative practices and experimentation with new patterns of teacher education and reeducation. Unfortunately, the efforts of the federal government have been spotty, fragmented and of short-term.

Teaching Materials. Textbooks and other teaching materials (Actually, they should be considered "media of instruction.") for the schools developed as a private enterprise rather than a function of the government. As mass production and other technological developments took hold, a flourishing textbook industry developed in the 1830s and 40s and with it marketing practices that have held to this day. Many criticisms were directed at the industry as witnessed by one writer in 1852:

> The houses of many of us are overflowing with the results of this misdirected industry and mercantile enterprise, so that not a few of us are obliged to refuse admission to any further specimens of school literature.... There can be no justification for the flood of dreary looking productions that are conveyed in the carpet-bags of courteous agents from town to town. (1:32)

By the 1860s lists were being issued of recommended textbooks for various subjects. This opened the way to state control of textbook adoptions, a practice which we have been unable in the intervening years to completely overcome as 27 of the fifty states still issue lists of approved texts.

Until 1850, the basic audiovisual materials in the public schools were the blackboard, maps and slates. It is interesting that the blackboard did not replace the slate which was an older device. In fact, there appears to be little connection between the spread of their use. The slate use continued until 1900 when the advent of cheap paper, pencils

and steel pens caused it to disappear. This condition has tended to obtain with the audiovisual inventions that were to follow, and today there is a tendency not for one to replace another. This has continued to complicate the situation both by increasing the cost of equipping a school and by increasing the problem of teacher training for their use.

Things are continually added to the school but little is subtracted. In the early part of the 20th Century, education in the United States was being influenced by leaders who advocated the visual-sensory approach to instruction. This led to the use of more non-projected, pictorial materials, the school excursion or journey, interest in bulletin boards and displays, and in the school museum movement. All of this formed an excellent backdrop for a relatively rapid introduction into the schools of a series of inventions that made possible new visual and auditory methods of instruction. Among these were the slide and the filmstrip, the phonograph, and the silent 16mm motion picture and radio in the 20s; the sound 16mm motion picture projector in the 30s and the magnetic tape recorder in the 40s and television in the 50s.

The growth trend as represented in number of teachers per piece of equipment leveled off about 1955 for most of the older types of audiovisual devices but growth is still continuing for newer ones such as television receivers, tape recorders, overhead projectors and video tape equipment and also for the small, relatively inexpensive models of equipment for individuals and small group use. This trend is clearly having its impact on the role of the teacher.

Teacher Education. Prior to the 1820s, no special education preparation was available to persons entering a teaching career. The feeling was developing, however, that teachers might profit by some training in dealing with small children. The liberal arts colleges showed no interest in the task, so a new institution was invented called the normal school. It gave its whole attention to the training of young people of high school age how to teach the elementary school subjects.

As standards became higher in the public schools, more competent teachers were required than were being produced by the normal schools and in 1879 the first chair of education was established at a university. This trend spread rapidly. Both methods of teacher preparation persisted into the 20th Century but by the 1920s the normal school, sometimes called the teacher training school, had practically disappeared. The concept of the four-year academic program resulting in a bachelor's degree at an institution of higher learning was firmly established.

Previous to 1920, teachers were instructed in the use of audiovisual materials and methods through exhortations and instructions provided in meetings when teachers assembled and through articles in professional journals. As the audiovisual tools became more sophisticated, formal courses in audiovisual education were organized and and presented. Efforts were mounted by the professional association of educators interested in audiovisual education to have one semester or full year courses available for teacher trainees. Later effort was made to get states to require a course in audiovisual education as a prerequisite for certification for teaching. The content of the introductory or basic audiovisual course centered on utilization, selection, equipment operation and evaluation and a little later production with particular emphasis on non-photographic materials. Only two or three states ever made the audiovisual course compulsory for all teachers and this requirement has now been removed.

The failure to require all teacher trainees to take an audiovisual course was not an indication that the number of course offerings was reduced. In fact, the opposite was true. But, regardless of the increase in the number, of course, the reports indicate that only 35.6% of the college and university graduates trained to be teachers have completed even one course on educational media and that only one out of four members of the education faculties are using media to any great extent in their own teaching.

The efforts to upgrade the "audiovisual skills" of teachers took various forms. Textbooks started in 1927 with a book by Johnson entitled Fundamentals and Visual Education. The early texts tended to be simply "cookbooks." Gradually, the philosophical basis for the use of audiovisual materials was introduced largely based on the importance of concreteness and reality as an aid to increased understanding. The "cone of experience" which was published first in 1946 by Dale became dogma. Great emphasis was given in the early courses to equipment operation justified by the belief that this was not only a useful skill but also tended to alay the fears of educators of the equipment itself. It has been only in the last decade that the course content has introduced roles of media other than presentation of data and the relationship of the use of media to the role of the teacher.

Another effort to upgrade the teaching of audiovisual education was the development of lists of competencies believed to be essential for the teacher. Among the lists that have been most influential were ones by Herbert Hite in the late 1940s; by David Pascoe in the 50s; the Lake Okoboji Leadership Training Conference list in 1958 and the cognitive, affective and psychomotor competencies developed by Meierhenry in 1966 (30:225-229) and the University of Wisconsin in 1969 (25:103).

Another attack on the problem of upgrading the audiovisual training of teachers in the pre-service sequence was a study of patterns for conducting the training. Attention centered chiefly on the following patterns: the formal course approach, the laboratory-project approach, integration of methods and audiovisual course content and various combinations of the three. Between 1959 and 1963, Torkelson conducted a study comparing four patterns for preparing pre-service teachers to use media. The patterns investigated were: the separate course, integration with methods, self-study and student teaching while on location in the public schools. The study suggested that:

> The process of self-discovery and personal involvement in determining the merits of audio-visual materials in teaching and learning may develop the attitudes which will result in greater utilization on the teaching job. (43)

Because only about a third of the teachers have any direct training in the use of audiovisual materials today, great attention is focused on in-service or continuing education of teachers; that is, providing this new competency to teachers already in service. This is accomplished in a number of ways. Many teachers go back to college campuses for summer courses; other formal courses, workshops, institutes and seminars are offered in off-campus situations, some by universities, some by state departments of education and some by school systems and professional associations. Teacher conferences, published materials, school visitations and exhibits continued also to play a role.

There are still too few educators who have any vision as to what education might become through appropriate use of media,or have the desire to change the status quo to determine the most effective learning systems for their students, or to evaluate their own teaching methods to identify inadequacies in their teaching techniques. Although equipment and materials are relatively plentiful, audiovisual materials remain an "aid" to the teacher, an adjunct to their teaching, chiefly used for presentational purposes to help the teacher clarify, introduce or summarize data.

Beginnings of Instructional Technology
1960 to Present

A small band of educators chiefly from the audiovisual field and led by James D. Finn, sometimes referred to as the Father of Instructional Technology, seemed to sense that they were living at a turning point in American education. They sensed that the wise application of technology to the problems of education could go far toward reforming and revitalizing the educational system. Unlike the majority of their fellow educators, they did not fear "the machine" but saw it as an instrument to achieve human ends. In fact, they went so far as to say that it was beneath the dignity of the human being to perform tasks that a machine could do as well or better; this concept was not new, having been expressed by Thorndike in 1912 - "A human being should not be wasted in doing what forty sheets of paper or two phonographs can do."

Technological Development Project

The National Education Association in 1961 undertook a three-year study financed by the U. S. Office of Education which was known as the Technological Development Project. The project was directed by Finn who wrote in the Forward of one of its many publications concerning the purpose of the project:

> The Technological Development Project is attempting to assess the impact of the potential technological revolution of the sixties--a revolution in the way in which young people and adults will learn and be taught--upon the American system of education and the educational profession.

Data collected by the project staff tended to indicate that education had about fulfilled the preconditions necessary for technological "takeoff." This was ably pointed out in the project's Occasional Paper #6:

> It is the mission of the Technological Development Project to attempt an assessment of this technological revolution in education. As indicated above, we view the present educational culture as analogous to an underdeveloped culture under assault by technology from the co-existing, highly sophisticated cultures of industry, business and even certain sectors of the government, such as the military and scientific sectors.
>
> If this position is accepted as true (and the arguments for such an acceptance are indeed persuasive), then the emerging patterns of thought regarding economic growth and development of underdeveloped cultures can be used to provide an analog model for the consideration of the technological revolution in education. (15)

Task Force on Functions of Media

In 1962, an audiovisual task force of more visionary educators was assembled by the NEA's Division of Audiovisual Instructional Service to consider the function of media in the public schools. Although the position paper developed by the task force was printed in AUDIOVISUAL INSTRUCTION, the official magazine of the Department of

Audiovisual Instruction, this organization of professional media specialists did not see fit to endorse the paper! (34) It is difficult today to see why this brief statement was considered somewhat radical in its day but because it was considered a cutting edged document, it is worthwhile to note some of the philosophy embodied in it.

> A technology of instruction, as any technology, will be a complex activity involving people, materials, machines, systems, and patterns of organization. Its application will involve, among many other things, the work of specialists stationed at all levels throughout the educational system. Without question, it also means changes in the school curriculum in the role of the student, the role of the teacher, and in the programs of teacher education. (Emphasis added by author.)

Some of the assumptions listed by the task force are also of interest:

> A new technology for instruction has been developed and proved through basic research and practice. This development has now reached a level that will permit rapid expansion of application and of further innovation.
>
> Methods of instruction will be modified to a major degree, particularly in the presentation of information.
>
> Teachers and learners will have new roles and changed activities as a result of this technological change.
>
> A new kind of professional will be required to provide leadership in design, implementation, and evaluation of programs of education which make the fullest use of new media.

In considering the role of media, the task force discussed two media functions and finally introduced the concept of the instructional system. The first function of technological media, the task force said:

> is to supplement the teacher through enhancing his effectiveness in the classroom. Educational media are both tools for teaching and avenues for learning and their functions is to serve these two processes by enhancing clarity in communication, diversity in method, and forcefulness in appeal. Except for the teacher, these media will determine more than anything else the quality of our educational effort.

In discussing media function #2, the task force said: "Some teachers have begun to utilize another channel for learning in which the media alone may present and, in a sense, teach certain content to pupils." "Here, the teacher determines objectives, selects methods and content, and evaluates the final learning outcomes. The presentation of information and even the direction of routine pupil activities, may be turned over to such new media as programed learning materials, television, or motion pictures.."

> Function No. 2, then, is to enhance overall productivity through instructional media and systems which do not depend upon the teacher for routine execution of many instructional processes or for clerical-mechanical chores. These systems will not be appropriate to every phase or purpose of the curriculum, but they offer the promise of vastly increased productivity in many instructional tasks. Their introduction will necessarily be gradual and must be accompanied by significant increases in the schools' technological capability.

About the instructional system, the task force said:

> The new media have led us to a new approach to instruction. This is a scientifically developed combination of instructors, materials, and technological media for providing optimum learning with a minimum of routine personal involvement by the teacher. The result is a carefully planned "system" consisting of subject matter, procedures, and media coordinated in a program-unit design which is directed toward specific behavioral objectives.

Three things stand out in this document: (1) instruction technology different from audiovisual education; (2) the use of media should be an integral part of an instructional system; (3) media and/or instructional technology can and must change the role of a teacher.

The paper, "The Function of Media and the Public Schools," pointed out two new media-related roles. The first of these was shared responsibility with media. This may seem like an exceedingly small step to those of us in education today but it was a traumatic step for teachers at the time. For centuries, they had taught in the privacy

of their classroom where they were largely self-sufficient and in control of the dispensing of information. The first response of many teachers was to teach as they had always taught and add the media input above and beyond their own teaching. This often resulted in a type of redundency. Two examples may be useful. An English teacher stated that he would not use the film, A Tale of Two Cities, until after he had finished teaching and testing on the novel. "Otherwise," he said, "How am I going to tell whether they learned the material from reading the book or from seeing the film." Toward the end of a year when a math teacher had been associated with an experiment involving programed instruction, the teacher related how for the first semester he had "retaught" the concept in each module of the program as though the programed instruction had not existed. This teacher was wise enough to revise his role during the second semester and to utilize his time with individuals and small groups in activities which emphasized the utilization of the concepts taught and the extension of the things learned into new avenues of discovery. Another teacher remarked to me that he would use more films in his teaching except for the fact that he felt lazy, as though he were sherking his role, when films were used in the classroom.

The second role of the teacher introduced by the task force was that of the "teacher on media." Heinich, a short time later, coined the phrase "mediated teacher" to describe the teacher who, rather than presenting information "live," placed his teaching on media; e.g., the radio or televised lesson or programed instruction. The teacher who appears on the television screen or who prepares the script for a televised presentation is indeed a teacher as much as the classroom teacher. This was soon recognized by professional associations when they emphasized the need for certified teachers on television as opposed to professional performers who were only directed by a teacher.

It was perhaps even more of an adjustment for the classroom teacher to accept this mediated teacher in a shared role than it was for him to accept the role of media which the teacher himself introduced into the classroom and controlled. This was aggrevated by the fact that the pupils adjusted rather quickly to having two teachers even to the extent of saying "hello" to the teacher on television as the set was turned on. The teacher on media soon found that he too had a role different from what he had had as a live teacher in the classroom. His role required more organization, more concern with presentational methods, consideration of pacing, etc. and, of course, he was always faced with the fact that for the first time his teaching was visible to others.

Tooling Up

As Finn pointed out in his study (15), the cost of tooling up for technology is great. A new technology of any size and consequence in a society such as ours can only be developed with considerable support from a federal government. The railroads, the highways, jet aircraft and the more recent space travel are all examples of this. In the United States in the late 50s, a great public concern to increase the quality of the schools was quickly followed by Congressional action. This was manifested by the sudden input of large amounts of money from the federal government available for purchase of materials and equipment and for the continuing education of teachers as well as to fund research and experimentation in the more affective utilization of new media. This influx of money was started with the National Defense Education Act of 1958 and has continued to the present time. In 1958, the annual expenditure of elementary and secondary schools for audiovisual equipment was about $62 million; by 1968, it was about $253 million.

In addition to the impact the funds made on the tooling up of the schools and the retraining of teachers, there was the attitudinal impact that came with federal legislation "to mobilize the latest and most effective communication technologies in support of classroom learning." Legislation went a long way in legitimizing the use of audiovisual materials in the minds of the teachers and perhaps, of equal importance, in the minds of the public, although it did little to increase the understanding of what educational technology was all about.

The schools were a pre-technological institution operating in the midst of a highly developed technological society. The public, faced with a shortage of teachers, rising costs of education and the failures of the schools to meet society's demands, began to raise the question of whether the newer technological developments of the military and of industry did not have some application to education -- concepts of cost effectiveness, of systems design and management, of planned change, reduction of labor-intensiveness, program budgeting and the like.

The period was marked also with rapid change in the hardware and software available to education. Not only was there a great increase in the quantity but also in the types of instruments available - the language laboratory; closed circuit television; dial access systems; cassette tapes; 8mm projectors; small, lightweight projectors for individuals; the video tape recorders and playback; and the overhead projector. Gradually, it became apparent that tools were available for a great number of the functions associated with teaching and learning:

> Storage and retrieval of information for example, through film and audio tape or computer
>
> Self-analysis - for example, using the language laboratory or the video tape recorder
>
> Distribution of information and data - for example, by television, radio or dial access

Interaction - for example, via the computer with light pen, student response systems, educational games and open-ended films

Self-instruction - for example, with programed instruction, 8mm motion pictures, loops and cassette tapes

Software too was becoming more sophisticated largely due to the impact of programed instruction with its basis in systems analysis and design. Software producers were beginning to feel the pressure to identify and state behaviorally the objectives being sought, to understand the difference between validated and non-validated teaching materials and to relate types of software to learning objectives.

There was much to document the finding of the earlier Finn study that education was ready for "technological takeoff." The schools were reasonably tooled up and there was an influx of additional money. There was enough variety in the hardware and software to allow it to perform various functions and objectives related to teaching and learning. There was technological know-how in the society outside of education which seemed to have some applicability to the educational problems and there was a demand for excellence, relevancy, accountability and productivity in education and a desire to extend educational opportunities to new fields such as early childhood education and adult education. What was lacking was knowledge of how to introduce planned change into a stable institution, the schools, which had a large pool of professional manpower which had been trained, for the most part, to view teaching as presenting, reciting and/or testing and grading and further to equate teaching and learning.

Technology and Methodology

New tools and techniques of instruction tend to change the goals, the content and the methodology of instruction. The latter is of more concern to us in this paper.

New tools, such as television and motion picture and overhead projectors, make it possible to deliver information to large groups of students simultaneously. On the other hand, tabletop viewers for slides and filmstrips, small transistorized tape recorders and the like made it possible and economical to make non-book materials available to individual students. These advances coupled with the long held dream of truly individualizing instruction and the need to become more efficient led to experimentation and adoption of various new methods of grouping students for learning activities and new patterns of utilizing the skills of teachers. Both of these trends are having immense impact on the role of the teacher, especially the trend toward individualization of instruction.

There are no highly reliable national statistics available about the adoption of innovations by the public schools in the United States, but a number of relatively reliable polls have been made. The Research Division of the NEA in 70-71 in a sampling survey of its membership obtained the following information about instructional practices in which teachers said they were currently involved. (35)

	Total	Elem.	Sec.
Team teaching	34.1%	38.2%	29.4%
Video tape use	26.6	25.1	28.3
Dial access or remote access	1.1	1.0	1.3
Nongraded classrooms	16.6	21.4	11.2
Differentiated staff	18.3	16.1	20.8
Cassette tape use	35.0	44.1	24.7
Programmed instruction	29.9	31.2	28.5
Modular scheduling	8.5	3.0	14.8
Computer-assigned instruction	2.6	0.5	4.9
Computer use in science or mathematics	2.4	0.5	4.6
Classrooms without walls	7.2	8.1	6.2

Several developments outside the public schools were also having an impact on the role of the teacher. Education in the military and industry was funded at a level

that enabled experimentation in methods of training. Further, there was not the commitment to the instructional pattern that existed in the public schools. Experience showed that in their training programs it was possible to use less professionally trained people with a heavier use of mediated instruction than was acceptable in the schools.

Another important development was in the area of performance contracting which got a major thrust forward when in 1970 the Office of Economic Opportunity provided $6.5 million for experiments whereby private companies could be employed by school systems in an experimental design to determine whether they could show higher achievement gains at comparable costs than could the regular schools when teaching basic subjects to failing students. It is noteworthy that the control schools involved in the latest performance contracting study spend from 64.4% to 80.9% of their funds on professional teachers' salaries whereas the performance contracting companies only spent from almost zero to 66.4% because of their greater use of funds for paraprofessionals and for materials of instruction. Teachers are also being nudged into new roles with the increased availability of "packaged courses" which utilize multimedia and incorporate procedures for the student and the teacher and frequently even incorporate the in-service education to enable the teacher to utilize the curriculum package.

It becomes quite apparent that we have at this time in the United States two levels of educational technology application in the schools. This, of course, is an arbitrary statement for discussion purposes because there is a great overlap between the two levels within a single school system and often within a single school, and perhaps the two should always to some degree both be present. But, because the role of the teacher is so different at Level One and at Level Two, it seems important to make the distinction. Snider has succinctly described these two levels:

Level One is characterized by the "audiovisual aid" or "product" definition of educational technology whereby the major end is to provide materials and services to classroom teachers on demand. At this level the curriculum and the teaching functions are enriched and supplemented by an array of media and machines that are nearly always under the control of the teacher. Here success is most frequently measured numerically in terms of student and teacher use of such resources. Newer developments such as computer-assisted instruction and cable television are used at this level provided they do not significantly interrupt established class organization, scheduling, and gradedness. In action, Level One is characterized by order and neatness

Level Two is characterized by a systematic or "process" approach to educational technology that is usually based on clearly stated learning objectives. Its major end is to maximize individual attainment for learners. At this level resources are considered to be a viable mix of men, media, and machines that can hopefully be adjusted to individual learning. Here success is measured in terms of learning output usually assessed on an individual basis. Newer developments such as computer-assisted instruction are often the basis for abolishing -- sometimes on an experimental basis -- class organization, group scheduling, and gradedness. The Level Two approach tends to force a consideration of basic questions about curriculum, staff functions, and instructional objectives. In action it does not look very neat. (37)

Technology and Teacher Education

Preservice Education. The coexistence of technology Levels One and Two in the schools presents a problem for teacher training institutions. Far more classrooms are operating at Level One than at Level Two. Hence, if the institution wishes to place its teachers after graduation in jobs which bring satisfaction both to them and to their employer, then they are encouraged to train for roles which support Level One use. If, on the other hand, they wish to train for the more innovative classrooms of today and the probable classrooms of tomorrow, then they should focus on roles which support the Level Two technology. What is happening in teacher education?

The vast majority of teacher education programs differ little from those of 20 years ago. Teachers continue to be trained in the standard foundations and methods courses and through the student teaching or practicum pattern without meaningful options. The preparation is in the context of the self-contained classroom oriented to the teaching of academic subjects. It assumes a teacher dominated learning pattern based chiefly on textbooks supplemented by other printed and audiovisual materials. The neophyte teacher is usually taught through telling with some showing of how it should be done. The practicum usually occurs at the end of the teacher training program and is frequently inadequately supervised and takes place in a "less than innovative" real school situation.

Innovative practices are beginning to appear often financed by federal funds. Many of these experiments have paid particular attention to the changing role of the teacher resulting from the impact of media. An example is the Wisconsin Elementary Teacher Education Project which was designed to develop exemplary teacher education programs for elementary schools. A quote from the abstract of the section of the model dealing with Media and Technology Education developed by Sullivan and Iverson will illustrate:

> But, in spite of the "rub-off" effects that participation in such a program will provide, it is believed that adequate knowledge and understanding of the production and utilization of media and technology can be attained only through direct instructional efforts which are systematically organized and made available to learners. For that purpose, the Media and Technology Education Element has been prepared.
>
> The Media and Technology Education Element includes three sub-elements: 1) Instructional Media and Mediated Instruction; 2) Instructional Techniques; and 3) Research. (25:104)

In the Wisconsin model, media and technology have been moved into the mainstream of teacher education and the elements that are to be included in the training program are competency-based. However, one notes that the emphasis is still on "aids," Level One, concept of technology. The information given to the teacher deals with selection, construction and utilization of materials which would be the type of training that would support the teacher operating in the Level One concept of technology.

Other innovative pre-service teacher education programs utilize laboratory-type experiences and self-instructional modules. An example is the program at Kent State University where the Instructional Resources Center is an agency of the College of Education serving the 217 faculty members and over 12,000 students of the college. The Center consists of five areas: the curriculum materials library, equipment training laboratory, production laboratory, self-instructional learning laboratory and auxillary services (video taping, photography and art services). Each area is supervised by one of the full-time staff members of the Center, coordinated by a half-time graduate assistant and additionally staffed by trained students. About one-third of the education majors elect the basic media course. Other students are exposed to the resources of the Center as a part of their methods courses, through orientation experiences and demonstrations, through use of the Center in relation to their student teaching work and by making use of the self-instructional opportunities of the Center.

A few quotes from recent personal letters will indicate the nature of the small experiments going on here and there in teacher education:

> We are experimenting with a course in which we attempt to demonstrate by precept some of the newer roles in teaching. In this course, we use specially prepared filmstrips accompanied with narrated tape which explains the illustrations in the filmstrips, and an occasional lecture demonstration during which interaction is encouraged.

> We at the University of Connecticut have not been able to move in any significant way into so-called independent study utilization. I do what so many other instructors refuse to do: get my prospective teachers to work, work at making creative decisions for using media for specific groups for specific objectives, both for groups and individuals. As far as professors are concerned, we do not and cannot use group methods. In our graphics and instructional development programs we work only with those who bring materials, who sense needs. This overburdens our staff now, and costs over $20,000 annually for supplies.

Changes are also taking place in the methods used to teach the teacher. This, of course, serves as an example to the teacher of methodology that they can use in turn. There is a growing trend among universities to set up teaching problem laboratories, centers for the teaching professions, instruction design laboratories and similar services known by many other names. The purpose of these is to help interested professors in redesigning their courses and the methodology which they use. The results may range from relatively little introduction of media to courses which employ audio-tutorial or complex instructional package methods of teaching courses.

Teacher education institutions are inhibited in their efforts to provide better experiences for teachers in the use of media and technology by a number of factors. Among these are:

1. The need to reeducate teacher educators regarding the nature and scope of instructional technology.
2. The difficulty in providing opportunities to practice innovative strategies as a part of the teacher training program.
3. The lack of equipment and materials in the college of education.
4. Too little time in the four-year teacher education program.
5. The need to train teachers for schools as they now exist.
6. The long accepted belief that the teacher is a generalist who, if given proper theory, can adapt to changes as they occurred in the instructional setting.

In-Service Education. The demands upon the public school, the dissatisfaction with teacher education and its inability to institute rapid changes and the influx of federal monies came together at the same time to focus on "retooling" the teachers already in service through institutes and workshops. These started in the areas of science and mathematics following the new curriculum developments and then spread to areas of foreign language, English, social studies, music and other curriculum areas. Since 1965, when the first educational media institutes were conducted, more than 10,000 persons have either been introduced to or updated in their skills and knowledge of instructional technology through participation in these institutes - again, largely Level One media institutes.

Impressive as these figures might seem, one has to consider that about one-quarter of a million new teachers are prepared for the labor market each year. If these are prepared for traditional classroom teaching, retraining through the institute program is really a loosing battle - a case of too little and too late. This has led to serious consideration of new ways in which the continuing education of teachers can be accomplished. One proposal is that basic preparation occur within the four-year program at the university with arrangements for a continuing internship program for one or two years carried on at the employing institution followed by provisions for continuing education based upon identified needs of the teacher. An alternative plan is a joint educational venture in teacher education between the universities and the public schools whereby the four or five years of training would be divided with part of it occurring at the university and part in the schools which would be used as laboratories. Interest in the continuing education of teachers has been fanned by research evidence which supports the view that teaching is not a generalized capacity to relate to children and solve instructional problems. Joyce states this well:

> The experience of innovative movements in education has shown us that the conception of teaching as a general capacity to educate is erroneous and disfunctional. Most teachers simply have not effectively adopted the new roles or learned the new strategies unless a massive inservice effort was made.
>
> However, if teaching is thought of as the ability to provide a particular, specialized kind of educational service, it becomes at once apparent that there are a multitude of specialized services which make quite different demands on the teacher. For example, helping children write creatively is different from teaching biology inductively. Helping children use instructional systems is different from providing counseling for them. No doubt some teachers can, without special training, move from role to role and strategy to strategy. That a few can do this should not deceive us into making the inference that all teachers can learn to do it as a result of general or even special training.
>
> It is far more productive to view teaching as a set of role-competencies each of which has to be learned specifically. From this stance a teacher becomes a person who can engage in one or more types of teaching. (24:156-7)

There is, then, a renewed interest in the continuing education of the teacher and some trends concerning new ways of accomplishing this. Current thinking embodies the idea that any innovation introduced into a school system must be accompanied by appropriate in-service training. The instruction should be specific to the skills required, program oriented and preferably occurring at the teaching site. In an attempt to meet these specifications, courses have been devised, competency-based modules on specific skills developed, microteaching introduced and attention to the including of teacher training in curriculum and materials packages.

One illustration is a project of Research for Better Schools, Inc., Individually Prescribed Instruction, an instructional system. During the project, it became obvious that teacher training was one factor that had to be given serious consideration in order for the project to succeed. It was further concluded that the retraining program for

teachers needed to be individualized about individualization and that whereas specifics about the mechanics of the system were needed there also was a need for theory concerning individualization. The training program developed for teachers was based on the same IPI model that the teachers were to use with the students. Not only was training needed to orient teachers to the individualized system but also continuous training for the refining of their instructional skills and strategies.

In the fall of 1967, another large program of individualized education was introduced, Project PLAN (Program for Learning in Accordance with the Need). This instructional plan also differed from the usual instructional program in its classroom organization, materials, method of instruction and teacher and student roles. For this reason, one of the important components of the project was the program for teacher development. PLAN put emphasis on teacher activities such as tutoring, counseling and instructing students in the technique of managing their own behavior. Observation of teachers, however, indicated that they were spending most of their time in organizational and managerial activities. The training task, therefore, was helping teachers modify their skills; acquiring new skills; reinforcing the procedures of acquiring new skills and modifying current skills; helping teachers maintain the new behaviors and extinguishing behaviors which were not compatible with Project PLAN. Each teacher-trainee was given an individualized program which grew out of observation of the teacher in his classroom to identify his training needs.

Another harbinger of progress is seen in the focus of current educational journals and in the titles of educational texts; e.g., Educational Technology: The Changing Role of the Teacher; Development Efforts in Individualized Instruction; Instructional Design; Planned Change. It is also indicative of the times that among books such as these is a new one entitled How to Use the Bulletin Board.

Future Trends and Their Implications

Teacher Role in Transition

Although authorities seem to agree that the role of the teacher in the majority of schools has changed little from the old "assign-test-grade" pattern, it is true also that a substantial percentage of the schools are making changes in curriculum, staffing patterns, grouping and organization of students and the like and that most of these innovations are "technology dependent." This means that they only can be achieved fully through the use of educational technology. In the schools with innovative programs, changes in the role of the teachers are slowly evolving. Authorities feel that the changes are greatest at the elementary level because of the greater flexibility permitted the teacher at that level.

Changes in teacher role occur gradually but teachers themselves seem to sense that their role has changed. A study made in which 3,000 teachers were sampled by the American College Testing Program of Iowa City, Iowa, got the response that teachers are called upon "to be more of a parent, counselor, policeman, and psychiatrist than a teacher. This could be interpreted to say that teachers recognize that their role is changing and that they do not like and/or are not prepared for the direction in which the change is progressing. The change is probably not in agreement with their view of the proper role of the teacher. (20, 41, 16)

Teachers and researchers involved in technology dependent innovations provide us with valuable clues as to the emerging role of the teacher. For this reason, a number of specific cases will be cited.

Oakmont Elementary School, Claremont Unified School District, California. Oakmont is a non-graded elementary school where programs are individualized for each child.

Practices which make this work are cooperative teaching, central attendance, multi-age classes and flexible groupings. The teachers make these comments on the differences of their roles in the non-graded schools in an unpublished report.

I. Teacher's prep time

> A teacher deals with lists of students and where each one is in the material chosen for him. A teacher ends up with several kinds of programs going on in the room at the same time in a given subject. The amount of record keeping is greater. The diagnostic period at the beginning of the year is critical. The teacher as a resource person for the student and his goals is a most demanding role.

II. Teachers and other teachers

> They work very closely with each other and it gets to be like a family. A tremendous amount of inservice takes place as teachers pool their various areas of expertise in order to increase the alternatives necessary for each child (who is assumed to be at different levels in all areas). There are running conversations that go on from day to day regarding where a child is best placed to perform at his best.

III. Teachers and students

> Since grade standards are out, individual programs must be set up. Teachers get to know more about students than when a certain level of achievement was assumed to go with a certain grade label. Labeling of all sorts becomes suspect. (The diagnosis is kept open.) Self-pacing is instituted where possible, and this relinquishment of some decisions appears to add to mutual trust. Acceptance is a key attribute for a teacher and is passed on to students. ("You are good in math, your friend is good in reading--everybody is different and that is a <u>good</u> thing, not a bad thing.")

IV. Teachers and administrators

> A principal cannot say what book a teachers is using in a given subject and must check with the teacher if a question arises. A team of teachers makes many decisions that formerly teachers did not need to make, e.g., certain books used to be distributed to each class by grade. A principal is in the position of helping teachers find alternatives. The range and variety of alternatives gets bigger and bigger, and both teachers and principal end up keeping a lot of data in their heads.

V. Teachers and parents

> Conferences center on the concept of progress (where he was, where he is, what can be expected.) With new parents, time is needed to explain the program. Without grade standards, conference time is required to reassure parents about progress.

McCluer High School, Ferguson-Florssant District, St. Louis, Missouri. The following is excerpted from a report from the school district based on observations of the impact on the teacher's role of extensive media use.

At first, most teachers viewed media as an adjunct, apart from their instruction. The quality and extent of their experiences were limited; reactions tended to be negative; that is, teachers viewed media as a way of mechanizing and dehumanizing instruction.

As successful models of media were presented and used by peers, more and more teachers saw media as means of providing more time for teachers to use meeting the needs of students. Media also provided more time for one-to-one teacher-pupil interaction. Once their views changed and media were considered a legitimate part of the unit experiences, the quality of use increased as did the quantity. Then,

1. Teachers began to differentiate media used with each class.
2. This led to differentiating media use within a class.
3. Teachers spent more time developing and organizing print and non-print materials.
4. Teachers spent more time working with media specialists, librarians, and reading specialists.
5. Many teachers began to see the need for and experiment with an individualized curriculum.
6. Teachers had to learn to use a wide variety of AV hardware.
7. Teachers used media as a means of solving weaknesses in their instruction--remediation, reteaching, closer examination of demonstration, etc.
8. Teachers spent more time designing curriculum.
9. Students started to use media as a means of communication in completing assignments.

10. Teachers started to use media as an area of study--English and social studies.

11. Service area (e.g., guidance) began to mediate parts of their operation.

Marshall High School, Portland, Oregon. A computer-generated, modular-flexible schedule. (Information from an unpublished report)

The goal is to individualize teaching and learning by breaking the school day into small modules of time to fit the activity taking place. Four teaching-learning modes are used: large group instruction, medium-sized groups for laboratory activities, small group learning experiences, and independent study. About 80% of the staff is organized into forty teaching teams. A typical teacher is involved in class activity approximately two-thirds of his teaching time, with one-third of the time given to student conferences, planning and evaluating student work or - if the teacher is a member of a team, working with other team members.

The large group, up to 400 students, situations are "presentor dominated" making heavy use of sight and sound. A considerable amount of advanced and detailed planning are required for these.

The feeling of the staff at Marshall High School is reflected in this statement by one member:

> From the teacher point of view, those of us in the science department are generally very happy with many of the aspects of the new program. We would not like to go back to the traditional fifty-five minute period, five days a week type of program. The longer laboratory periods are very valuable. The freedom that students have to come in and make up work, go over work again, add to their work and initiate new ideas is very valuable. The opportunity to have teacher-student conference time within the school day is helpful. The freedom and relaxation of the new program is valuable to us, and the teacher-to-teacher contact including day-to-day critiques, either vocal or observed, of each others' work has helped us all to grow. Planning with each other, we have the combined strengths of at least two people's ideas whereas we used to have little more than our own ideas to call upon. The variety of the program from day to day is stimulating in itself. Problems have not disappeared, but we now have some new and better ways to attack them.

Multi-Unit Elementary Schools Developed by the Wisconsin Research and Development Center for Cognitive Learning. In 1971, about 70,000 children in 600 schools in 27 states have been involved in a multi-unit plan which is an organizational pattern that replaces the self-contained classroom with a non-graded instructional unit. Each unit contains 100-150 children within four age groups, 4-6, 6-9, 8-11, 10-12. Each unit has a leader or master teacher, two or three staff teachers, a teaching intern and one or two aides. The unit staff is supported at the next level by the "instructional improvement committee" consisting of a school's unit leaders and principal. Above this, there is a school-system wide policy committee. This design is considered to be the first step in a new system of elementary education called Individually Guided Education (IGE). A study conducted by the University of Oregon showed that teacher morale and job satisfaction were higher in these multi-unit schools. It also found that multi-unit teachers spent more time planning for instruction and specialized more. The study also showed that children in the multi-unit plan received more attention from teachers individually and in small groups.

Individually Prescribed Instruction (IPI) and Project PLAN - Individualized Instruction. (45) We have previously spoken of IPI, a programed system, which is now being used in more than 300 school systems in 38 states and of Project PLAN which uses available instructional materials, a curriculum map of 4,500 culmative behavioral objectives and the input of student records which, with the aid of the computer, helped the teachers make personalized plans for 30,000 students last fall in schools scattered throughout the nation.

In IPI and PLAN, and in any of the other more structured systems for individualizing instruction, the role of the teacher seems to fall into three categories: (1) operating

the system; (2) supplementing the system to enhance adaptation to individual needs and (3) providing for the achievement of goals possible only with teacher intervention. It is evident in all cases that careful preparation of teachers to carry out these new roles is necessary as a part of the program introduction.

Individualized Instruction - Edling Research. (13) In 1968, Edling collected data on over 600 programs of individualized instruction throughout the United States and selected 50 sites for visitation. These were sites that represented a wide spectrum of procedures, four types of school districts and the major geographical and population areas of the United States. The study found that the single most essential element for successful implementation of an individualized plan was additional training and planning time for teachers and administrators. Most teachers needed to develop new skills in diagnoses and in prescription preparation. The study recommended that staff training and planning time be initiated well before the attempt to implement even a pilot program is undertaken. In addition to acquiring new knowledge and skills, teachers must select and prepare new materials and practice the administration of these materials until they develop the competency comparable to present group oriented procedures. A second and almost equally essential element, teachers said, was additional materials of instruction.

Teachers said that there is more work involved in an individualized instructional program but, at the same time, the majority felt that they have never been more satisfied in their teaching experience and would not wish to return to a traditional instructional program. Some teachers, however, did not feel comfortable with the individualized format. The hardest adjustment for the teacher is during the first two to six weeks of the program.

In Summary. It seems evident that as the learning environment becomes more "media rich" and "technologically oriented" the direction tends to be away from the lecture-tell method and in the direction of discovery methodology and more individualized instruction.

This tends to increase the time the teacher spends with individual students and in tasks involving management, diagnosis and prescription. Edling sums up the situation when he writes:

> The great problem posed in education by the development of these new communication media is the difficulty for those who have been brought up in an earlier tradition to visualize a role for themselves in their chosen vocation other than as primarily transmitter of information. The traditional role of information provider, which has come to be viewed as a primary one, is probably one of the least efficient and effective that teachers can perform in the learning process; this fact has been demonstrated repeatedly in experiments on human learning.... The teachers' great potentialities actually exist in his capabilities for observation, evaluation, and adaptative response.

Predictions for the Future

It is evident that innovation is now an accepted concept in education, and it also seems apparent that most of the innovations being tried today are technology-dependent. When a technological advance is made, it is impossible from looking at the beginning stage to predict with accuracy what the end result will look like. This is as true for education as it is for other aspects of society, but we must try, from the transition stage that we are now in, to identify general trends or directions. A sizeable number of scholars and researchers have been trying to do just that and it may be helpful to examine the direction of thinking that a few of these have taken.

Hansen and Harvey. In their research study on "Impact of CAI on Classroom Teachers" (18) the following generalizations were projected:

1. Teachers will perform much less of the informational presentational function presently found in our classrooms.

2. Teachers will play less of a corrective role in terms of their questioning and evaluative behavior.

3. Teachers will become more concerned with a host of individual characteristics important in designing instruction strategy; thus, the array of instructional resources and the decision making found in employing these resources will become more complex and also more frequent in terms of teacher behaviors.

4. The teacher will have a greater involvement in guiding individual students rather than maintaining classroom discipline.

5. Teachers will have to perform a wider range of discussion techniques involving a richer opportunity to affect the social and emotional behavior of students.

6. Teachers will have a greater array of differentiated professionals joining them in the team effort to provide optimal instruction.

7. Teachers may take on more of the diagnostic assessment and prescriptive functions presently assigned the school psychologist.

Heinich (19:139 and 154)

> It is clear that the technologies of instruction can be assigned the burden of direct teaching, and decisions concerning method, materials and content are made by the professionals who are responsible for incorporating instruction in mediated forms.
>
> Eventually, technology will shake up education the same way it has industry: a reshuffling and reassignment of personnel. Two decades ago the number of teachers engaged in mediated instruction was extremely small and limited pretty much to films and educational radio. The number of teachers involved in locally produced media was, of course, even smaller. The last decade has witnessed a sharp increase in teachers engaged in mediated instruction due principally to the introduction of educational television, programed instruction, and the language laboratory.... In twenty years, perhaps one-third of the teaching profession may be engaged in preparing instructional materials with little, or no, direct face-to-face contact with students. When education understands this at the operational level, less concern may be expressed about replacing teachers - they will be "re-placed" to the other side.

Loughary (28:109)

> It is (or at least, soon will be) highly misleading or inaccurate to speak of "teachers" as a general professional group.
>
> The new teacher must have a method--a system, if you will--for determining what teaching resources are available and for constantly deciding how best to use them with individuals and groups of pupils of various sizes. Instruction will become increasingly dynamic and complex, and more of the teacher's attention will be needed to monitor and control the instructional process so that students will be engaged in maximally effective learning at all times. Students, we suspect, having experienced truly individualized and enriched instruction and immediate feedback of the results of their work, will <u>demand</u> rich and meaningful instruction.

> Man-machine systems in education can contribute tremendously to the individualization and enrichment of instruction, and at the same time will exert great pressure toward changing traditional teaching functions. It is not a question of whether the requirements of teaching will change, but rather one of how much time there is to prepare for changing requirements.

Trow. (44:159)

> At least six different categories of subject matter specialists may be expected. As learning materials centers are developed librarians and audiovisualists, as curators and consultants, will advise staff members and students in the use of available materials. Programmers will select, revise, and construct films, tapes and programs for specific local purposes. Monitors will be needed (they have already appeared in language laboratories), to run the several subject matter laboratories, to see that the different kinds of apparatus are operating satisfactorily, and to see that materials are properly distributed; but primarily to help elicit and reinforce correct responses. They can even serve as what might be called "climate-control officers" to help create a friendly, rewarding social atmosphere. And demonstrators now called TV or studio teachers, will be those especially talented in presenting material via this medium.

Broudy. (33:92) Broudy envisions three types of personnel: (1) instructional technicigians whose responsibility would be to assign pupils to instructional programs and reassign them as the demand of individualized instruction dictate; (2) instructional programers whose job it would be to write the programs that are fed into the system and (3) instructional managers whose responsibility it would be to turn the instructional packages into schedules to be implemented by instructional technicians and to exercise general supervision over all instruction.

Ward and Jung. (33:308) Ward and Jung also make a number of predictions among them that technology will increasingly supplement but not replace the classroom teacher; the functions of the teacher will be performed more effectively as a result. They also see a growing array of learning materials media and instructional strategies becoming available about which the teacher will need to make rational decisions. More specifically, they say:

> The teachers role in the future is likely to feature: (1) a decreased emphasis upon information-giving; (2) increased attention to the development of higher order cognitive outcomes; (3) increased attention to the development of constructive affective outcomes; and (4) the integration of both cognitive and affective processes for the improvement of learner outcomes.

Rosove. (14:13) (Rosove was a member of a team funded in 1967 to conduct studies of future educational needs and resources which included the possible roles of educators in the late 1980s.)

> This point of view has profound implications for educational policy. It places the "teacher" in the nerve center of the man-machine learning system. It makes possible a transformation in the traditional role of the teacher. While the machine takes over the function of dispensing facts or data, or the explanation of a concept or theory, the teacher (1) serves to facilitate the learning process by providing assistance, guidance and counseling as needed by the student; (2) designs and conducts experiments on the learning process using the actual learning situation as his laboratory; and (3) contributes to the development of improved man-machine learning systems and procedures.

Tabachnick and De Vault. (25:43)

> It may be anticipated that those activities which today occupy a major portion of the teacher's time will not have the same priority on his time in schools after 1975. New activities and new responsibilities for teachers may be expected to evolve.
>
> Before considering these potentially new roles, a review of the roles which teachers presently assume is in order. These, in order of priority on the teacher's time, may be listed: (1) information transmission; (2) management and administration; (3) guidance; and (4) modeling.
>
> In schools beyond 1975, it may be expected that this order of priorities for teacher roles will be precisely the opposite order from that in which they are perceived in traditional schools. Teachers will serve primarily as models and as guidance counselors and only incidentially as managers and administrators.

Doyle and Goodwill (12) This research study utilizing the Delphi technique asked a panel of over forty experts to forecast the direction and degree of change in societal values, the liklihood of the development and widespread adoption of educational technologies and changes in the role of the teacher over the next thirty years.

> Some of the changes forecast are most interesting and even startling, when viewed in the historical context of student-teacher-classroom relationships.
>
> Over the next fifteen years we may expect to see the phasing out of one of the long-established approaches to teaching and the phasing in of one which will be totally new. The educational process has been characterized by what we have called "the traditional imparting of knowledge" whereby the teacher or instructor leads or directs the class while "encouraging interaction and group learning." We can expect to see a continuation of this teaching approach up to the middle or latter part of this decade. At that time we may anticipate an important change as the teacher begins to perform as a "group leader," while acting as a "catalyst to the learning process." As we approach the mid-eighties there will be a further significant change as the teacher becomes more of a "sympathetic resource utilized at the students' request." Naturally, this implies a major change in our concept of "teaching," and in our concepts of "education" and "learning." This also implies a number of other possible developments.
>
> ...Thus the picture which this narrative presents is one of more and more student involvement and participation, and of more individually tailored curriculum, with the teacher having less of an authoritarian role - a picture which is entirely consistent with what was outlined in the section on societal value changes.

In Summary. According to the experts, a number of trends are indicated which are of strategic importance in predicting the future role of the teacher.

1. Individualization of instruction

   This is not to be confused with self-instruction or independent study although it usually makes use of both. It does mean the end of lock-step education and the recognition of the importance of individual differences.

2. The humanization of education

   This includes successful learning for all students; options for teachers; choices for the student concerning what he learns, when and where, how he learns it; changed patterns of student-peer-teacher relationships.

3. A futuristic look in education

   The focus appears to be away from learning facts about the past to learning how to learn, the inquiry and problem-solving methods which enable individuals to cope better with a rapidly changing world and with uncertainties.

4. More emphasis on cost effectiveness in education

   Technology has embodied in it the systems concept with its constant evaluation, feedback and readjustment cycles. It also embodies the concept of tradeoffs and reallocation of resources and may well lead to a readjustment of budget allocations in education.

5. The disappearance of the teacher generalist

   This is partly a recognition of the varying needs of students but also of the fact that teachers too are individuals with varying capabilities and life styles. The trend seems to be toward a team of more specifically trained teachers with a support staff of men and machines.

6. A change in man-machine relationships

   Men and machines will cease to be protagonists but will operate within a system playing related but distinctive roles toward the achievement of objectives.

7. A shift in emphasis from teaching to learning

   This is succinctly stated in the concept that if the student hasn't learned, the teacher hasn't taught; thus, the burden of proof is shifted from the student to the teacher.

Implications for Teacher Education

The prospective teacher entering college today will not be in the teacher market for four or five years and, in the mean time, education has moved forward five years so there is almost a ten year lag between the entry time of the prospective teacher into college and the time when he will be working in an educational setting. There is also evidence

that the so-called educational "theory-into-practice-lag" which once was said to be fifty years and which has dropped to twenty, may, in the near future, be reduced further. It is necessary, therefore, that we train teachers for the future and not for the past, perhaps, that we train them for a life of professional change per se.

It is not the function of this paper to deal with current and projected patterns for the reorganization of teacher education. It does seem appropriate, however, to make a few generalized comments about the implications for teacher education of the predicted role of the teacher. It should be obvious that new concepts and skills should not be merely pyramided on top of current patterns and content of teacher education, but the whole needs to be redesigned and substituted for much of the current content and methodology.

1. The teacher of the future will need to have a working knowledge of technology including man-machine relationships, the scientific method of problem-solving, and particularly technology as applied to educational practice. This will include a compassionate understanding of the truly humane task of the human teacher, preparing or choosing teaching objectives, management of systems, and the like. Le Baron summarizes this change of focus:

> It would seem that technology offers a teacher a terribly exciting opportunity. Let's suppose that 70 or 80 percent of what the teacher now does is mechanized. This means that the remaining 20 percent--the truly human aspects of teaching--can receive 100 percent of the teacher's attention....
>
> The essentially human functions, then, are choosing--developing and reacting to unique situations; feeling--being emotional and loving, a total person as it were; creating--designing the machines to relieve the routine and release the chance to feel; and cognating....
>
> In brief, teaching is a system of actions intended to induce learning. (27:451)

2. The teacher of the future will need the abilities required for selection, modification and/or production of instructional materials and other systems. In other words, instructional design should be a part of the training of the teacher. It is good to note that among recent textbooks appearing are ones entitled Teaching and Media: A Systematic Approach, Gerlach and Ely; Instructional Design: A Plan for Unit and Course Development, Kemp (26); Instructional Systems, Banafy (5); Instructional Design: Readings, Merrill (31); and Selecting Instructional Strategies and Media: A Place to Begin, Merrill and Goodman (32).

3. If teachers are not to be threatened by innovation and a new role, the development of supporting attitudes is essential. It appears that the teacher of the future should not be threatened by non-structure in the environment or by non-directive situations, or by trial and error developmental work. He must be comfortable with having his teaching visible to his peers, and at times, as via television, by the community. He must be able to take criticism and evaluation. He must get more job satisfaction from seeing learning occur than in the performing of a skillful teaching act. In short, he must become a professional in the true sense.

4. The teacher of the future must feel comfortable with and be skilled in a team operation. This means learning to share decision making, skillful use of support personnel, student and parent involvement in the teaching-learning enterprise, and operation in an inter-disciplinary setting. Team operation also implies differentiated roles. Teacher education programs need to differentiate between these roles and develop training programs for specific skills. Probably for this reason, teacher education will become more competency-based. Teachers will need to be guided into the types of roles which suit their competencies and life styles.

5. One trend that seems certain for the future is that toward the individualization of teaching and learning in order that the potential of each student will be developed in accordance with his capabilities, interests and needs. This means that teachers will need to cope with a more pupil-centered learning situation and one in which the student is much more active than he has been in the past.

Wisegerber (46:250) lists some nine areas of competency which he feels are paramount for training teachers for individualized instruction for each child: (1) specifying learning goals; (2) accessing pupil achievement of learning goals; (3) diagnosing learning characteristics; (4)planning long-term and short-term learning programs with

pupils; (5) guiding pupils in their learning tasks; (6) directing off-task pupil behavior; (7) evaluating the learner; (8) employing teamwork with colleagues; and (9) enhancing development.

6. In the school of the future, the teacher will have more opportunities to work with students on a one-to-one tutorial basis. This personalizing of education will require a set of skills which Merrill has characterized as social interaction skills (31:55). These include skills of personal relationships which enable the teacher to establish personal communication with his students and also the knowledge of group dynamics which enables the teacher to promote group processes that otherwise facilitates learning outcomes among students. Being able to motivate students and to set up contingencies which reinforce growth that will also be an important role

Problems Ahead. Whether or not the predicted future will come to pass, and if so, at what rate, will depend to a great extent upon how certain problems and questions are answered. Of the many that can be identified, six of them have been selected for discussion.

1. There are many things we need to know before we can proceed competently with the innovations in education. To get some of the answers will require basic research, in other cases, feasibility studies.

   We certainly need more effective measures or indicators of success or failures of the innovative practices. On the standardized tests, there seem to be, for the most part, "no significant difference" but observations often tell us that pupil behavior and the job satisfaction of the teachers changes toward the positive.

   We need to know much more about teaching styles and how to identify them, about learning and cognitive styles of students and how to identify them, and the significance of matching teaching styles and learning styles. We need to know how to relate materials of instruction to teaching and learning styles and learning objectives. We need to do task analyses of teaching in order to refine and define what teaching is. We need to identify which are the "human" roles in teaching and which roles can be handled by mediated methods.

2. Another major problem area is that of changing the institutions of education and teacher education and the behavior of teachers.

   As pointed out earlier, the problem in the United States is complicated by the fact that our educational system, including teacher education, is decentralized. For this reason, it is impossible to make changes by edict from the top or even at the state level. Change has to take place

in thousands of schools and school districts throughout the United States on an individual basis. This is costly and time consuming. As Lloyd Trump has remarked, "Every principal knows that it is not easy to pierce the barrier of the classroom door." Regardless of what type of demands, urging, cajoling or in-service education has taken place, when the teacher closes the classroom door of the self-contained classroom, what he does is under his own control and is usually adapted to his own teaching style. To a large degree, the teaching act today can only be described as taking place in a pre-industrial age, cattage industry kind of milieu - a situation that has been solidified into a government gureaucracy of enormous dimensions.

Even when teachers are desirous of introducing innovations and changing their roles, they frequently find that they are inhibited by various administrative routines, budget controls and the like. In a recent letter to the author, Hamreus summarized these problems as follows:

> My own experience would cause me to make the following (compressed) observation. Technology changes the role of teachers only when the rest of the system changes sufficiently to permit the teachers to change. In other words, teachers can be taught to utilize new innovative teaching techniques but usually are kept from doing so because (1) her fellow teachers are not equally prepared and thus create an overwhelming resistance; (2) her administrators are not convinced it is necessary and thereby resist the expenditures or reorganization of resources required; (3) the constituency of the school is suspicious of its relevance and thereby creates a resistance force; (4) the teacher education section of the college or university servicing that area are not convinced or trained in the innovations application and thereby are non-supporting; (5) the State Department has individual proponents but has no clout with the "door keepers" in the school district to give the teacher the needed support.

The whole problem of institutional change as it applies to the education system in the United States was summed up neatly in one sentence in a recent educational publication of the Association for Supervision and Curriculum Development: "What emerges from this consideration of the system of education in the United States is an enormous capacity to absorb change while not changing at all."

Many of the innovations now being introduced into education are dependent upon our ability to change society's view of teaching as well as the self-image of the teacher. Research evidence indicates that we are most successful in causing the teacher to alter his role if he is involved in planning and implementing the innovation. Some authorities, and they are supported by considerable research, doubt that teachers in service can be retrained in such a way as to significantly affect their teaching style.

Joyce (24:182) reports research to show that "classroom styles of teachers are more notable for their similarity than for their differences and that it seems possible that there is indeed a national teaching style which has certain definable characteristics." He also relates how the behavior of student teachers is shaped suring their practice teaching so that students become less open and less flexible and are thus molded into the style of the national norm. Some research indicates that teaching style varies as a result of teacher personality, but further research has indicated that teachers of very different personality types can learn a very large variety of teaching strategies. Joyce draws these conclusions: (24:192)

> The homogeneity of teaching styles, combined with the relative homogeneity of curriculums and school organization patterns, indicate that teaching has been a normative rather than a technical activity. That is, teachers have been behaving according to a normative concept about what teaching is, and they, consequently, look similar when they are at work. A technical concept of teaching defines teaching as decision-making skills and teaching strategies which the teacher applies to each teaching situation. When he does this, the results vary greatly, for his decisions are different in every case and his strategies vary as a consequence. Hence, a technical concept of teaching leads to a more heterogeneous picture than we apparently have at present, because it assumes that teachers will use their skills to create a variety of environments tailored to the needs of their students.
>
> Performance-oriented education has to be built on the assumption that teaching is a technical matter--a process of decision-making, interacting with children, developing of content, etc. The clustering of teaching behavior around indentifiable norms suggests that it has been an intuitive, imitative act.

> Probably the implementation of performance-based education will require the socialization of the education profession into a technical stance which is foreign to the norms of contemporary practice.

Innovators are hampered by our lack of knowledge about how to introduce planned change into institutions. Although the literature in this field is increasing, there is still a lack of feasibility and field studies. There is an argument in education as to whether innovations should be introduced gradually on a piecemeal basis or as a total system such as when a new school is opened or a new curriculum introduced.

We do know that acceptance and success of innovations are reduced when innovation is contrary to the beliefs and attitudes of the person whose role is to be changed. One of our problems, therefore, is the fact that many teachers and administrators in the educational system are not convinced of the relevance and effectiveness of instructional technology. We may be more successful if we can convince teachers that technology provides to them the opportunity to capitalize on their uniqueness through task differentiation and by assigning less rewarding functions to media.

3. A third problem area relates to the question of whether or not the current method of development and distribution of instructional materials and equipment can adequately supply, at acceptable prices, the hardware and software needed to implement instructional technology. Although a few schools produce some teaching materials, fewer will probably be able in the future to develop satisfactory competency-based materials. The development, production and distribution will probably fall, as it is at present, largely to the highly competitive profit-making education industries. The federal government has taken some interest in the development of experimental curriculum packages, but their support has been only a "drop in the bucket" and the development cost of the new types of teaching materials are tremendous when compared with the textbook development of the past.

In the hardware area one of the problems is the matter of the lack of reliability and compatibility of the equipment. There is a danger of standardizing new equipment too rapidly, but failure to standardize at the appropriate time causes problems of software utilization. Being at the mercy of the profit-making sector of society we in education frequently find that we are adapting to our needs equipment that was originally produced for the general public market. At the same time, we have not been in a position to specify our needs to the producers of equipment and materials. Schools must develop the will and capacity to specify with much greater precision just exactly what their needs are. A technological society such as ours can produce just about anything once a market for it has been clearly specified.

4. What stance should software producers take concerning the role of the educator in relation to curricular packages? Can he assume that the package can remain intact or what some people refer to as "teacher proof?" In this case, the educator's role is to select from multiple packages in the same curricular area. On the other hand, if the producer can assume that the teacher will function in the role of adapter or modifier of a curriculum package, he will tend to provide the teacher with a loosely structured set of materials which he can adapt to suit his own teaching style and the learning needs of students. To what extent should teachers be trained to design their own instructional units? In this case, the role of the commercial producer is different again.

5. Teacher militancy is growing in American education. It has to date had great influence on matters of salary and fringe benefits. It began as trade unionism but now the same type of contractual negotiations are being spread more and more to instructional areas - professionalist. In the not too distant future, this may have a tremendous impact upon the rate at which innovations can be introduced into schools. The subject is important enough to have warranted a research grant from the Office of Education to study teacher militancy and instructional media. Dawson found that the teacher leaders

interviewed believed that teachers were relatively uninformed in the area of instructional media and that there might be a possible loss of classroom autonomy for the teacher if media were to be used extensively in the schools.

The application of instructional media will have implications for teacher welfare and working conditions. It also means that money for the purchase of the materials must come from already inadequate school funds and will, therefore, be competitive with teacher salaries. For these and other reasons, instructional media and technology will increasingly be a part of collective negotiations. We may find the teacher faced with a choice between higher salary or better teaching material. One alternative would be to purchase some of the larger blocks of curriculum packages from capital funds spread over a number of years rather than out of current operating budgets, but this to date has been tried in very few places. Because the initial cost of the introduction of technology is very great compared with usual expenditures in education, some alternative financing plans may be essential.

6. The current debate ranging both in educational and lay magazines of "technology versus humanism" is also a deterrent to the introduction of instructional technology in the schools although it can easily be shown that much of this debate reflects serious misunderstanding of both "technology" and "humanism." Technology in itself is neither good nor bad, humane or inhumane. The morality of any technology is a function of the human use and human ends - that is, new moral issues are raised and we are forced to reexamine our goals. This is true in education as it is in the rest of society which is just beginning to realize that because technology makes something possible is no reason for doing it.

Steps to Facilitate Role Change. There are steps which could be taken today and which have the possibility of hastening the introduction into the schools of educational technology and the accompanying role changes of teachers. Twelve are considered here.

1. Introduce technological innovations where established teaching patterns do not currently exist, e.g., pre-school education, education of the handicapped, in rural areas lacking educational facilities, educational broadcasting, the open university concept, the high school completion course via correspondence, dial access to library collections and the like.

2. Introduce curriculum packages in modular form so that sequences shorter than a "total course" can be used; incorporate the instructions to the teacher as a part of the package; allow certain options and adaptations to be made by the classroom teacher.

3. Find ways to make more planning time available to teachers through team teaching, use of teacher aides, etc.

4. Make the new teaching materials available directly to the student, that is, bypass the teacher. Students are more comfortable with the new technology than is the teacher. Where the materials have been available to the student, for example, via dial access in the library, students have made great use of the materials.

5. Secure appropriations at the national level for investment in production and field testing of instructional packages with subsequent production and marketing through commercial channels.

6. Require when federal grants of "stimulus funds" are provided for innovative projects, that provision be made for the linking of planning, teacher re-education, supplying of materials and equipment and evaluation.

7. Encourage the establishment of educational institutions of differing types of philosophies and teaching methodology and give teachers, parents and students a choice of the type of institution. Spend the necessary funds on careful, long-term assessment and follow-up evaluation.

8. Provide, at no expense to the teacher, professional development activities at the teachers' teaching site and at the time of need and on problems identified by the teacher.

9. Increase the ease of use and ease of access to teaching materials and equipment for the teacher and student.

10. In the student teaching experience provide opportunities for team teaching and mediated teaching, and attempt to instill acceptance of "visible teaching," self-criticism, and experimentation.

11. Throughout the pre-service teacher education program introduce a more updated concept of teaching with special consideration of the unique role of "humans" in the teaching process.

12. Encourage management scientists and operation analysts to make education one of their fields of study.

Conclusion

The economics of education have already cast a long shadow on the future of school finance in the United States. Some basic constitutional questions are now in the courts challenging the fiscal basis of our present means of school support. It has been clear for some time that present tax structures are not adequate. It is also clear that a small but alarming number of our school districts are now facing bankruptcy, and that the cost of our present school system has been increasing over the past few decades at an exponential rate. As a matter of fact, the gross national product (GNP) has been projected together with the cost of public education. At present growth rates, it has been determined that by the year 2080 our total GNP will equal the total cost of public education. This statistical exercise has a meaning that must not be lost as we contemplate technology and the school, how they will inter-relate increasingly, and how all of this will, without question, change the role of the teacher.

In this paper, certainly, more questions have been raised than answers given but, as was stated in an introduction of a recent publication:

> ...in the process of clarifying thinking on an issue, one often raises more questions than one answers. This can be annoying in a society that prides itself on demanding, and getting, answers to problems and then moving briskly on to new problems. And, as Socrates discovered, raising questions can be more than annoying, it can be downright dangerous.

It is certainly evident that the educational community is surrounded by a technologically based society which is only now beginning to affect to any great extent the role of the teacher. Although change is very slow in education, it has been occurring at an ever quickening pace. The education of the child today, particularly at the elementary level, is different both in content and methodology from the education received by his parents.

Within ten years, that is, in the early 1980s, we should be able to see very pronounced changes in the role of the teacher as more rapid applications of media and technology in education occur. The next twenty or perhaps thirty years should probably be looked at as a period of transition. Toffler in his book, Future Shock, speaks to this point:

> Mass education was the ingenious machine constructed by industrialism to produce the kind of adults it needed. The problem was inordinately complex. How to pre-adapt children for a new world--a world of repetitive indoor toil, smoke, noise machines, crowded living conditions, collective discipline, a world in which time was to be regulated not by the cycle of sun and moon, but by the factory whistle and the clock. The solution was an educational system that, in its very structure, simulated this new world.... Our education systems had not yet fully adapted themselves to the industrial age when the need for a new revolution--the super-industrial revolution--burst upon them. And just as the progressives of yesterday were accused of "presentism," it is likely that the education reformers of tomorrow will be accused of "futurism." For we shall find that a truly super-industrial education is only possible if we once more shift our time-bias forward.... Education must shift into the future tense. (42:343-44)

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